BASIS FOR EPA'S PARTIAL DISAPPROVAL
OF WASHINGTON'S 2003 WATER QUALITY STANDARD REVISIONS

Overview

EPA received Washington's July 2003 Water Quality Standards revisions (2003 WQS) on August 1, 2003. The water quality standards submission contained the specific revisions to the regulatory language at WAC 173-201A, the Lt. Governor's certification that the revisions were duly adopted in accordance with State law, a summary of the changes made to the State's water quality standards, the State's response to comments document, and technical reports.

As part of the WQS revisions, Washington changed its standards from a "Class-based" system to a "Use-based" system. Washington's 1997 water quality standards (1997 WQS) used a "Class-based" system which assigned each water body to a particular "Class." For example, fresh waters were assigned to either Class AA, Class A, Class B, or Lake Class. Each "Class" contained a suite of beneficial uses (i.e., water supply uses, recreational uses, fish and shellfish use, etc.). The 2003 WQS revisions removed the "Class" system and instead applied the beneficial uses that were contained in a "Class" directly to specific water bodies.

The "fish and shellfish" use that was contained in each of the 1997 Classes was divided into six aquatic life use categories in the 2003 WQS, as follows:

- Class AA and A water bodies were designated as "Char" waters if Washington knew or had reason to believe that char spawning and rearing took place in those waters;
- Lake Class and Class AA waters, not otherwise designated as "Char" waters, were designated as "Salmon and trout spawning, core rearing and migration" (hereafter referred to as "Core");
- Class A waters, not otherwise designated as "Char" waters, were designated as "Salmon and trout spawning, non-core rearing and migration" (hereafter referred to as "Non-core"); and
- Class B waters were designated as "Salmon and Trout rearing and migration only" (hereafter referred to as "Rearing and migration only").
- Washington also adopted a "Non-anadromous interior redband trout" category and an "Indigenous warm water species" category, however, no water bodies have been assigned to these two categories.

Washington developed a temperature criterion[1] for each of these aquatic life use categories. The temperature criteria are:

[1] The metric for the temperature criteria in this document is the 7-day average of the daily maximum temperature (7-DADMax or 7-DADM) unless otherwise noted.

Char (bull trout and Dolly varden)	12° C
Salmon and trout spawning, core rearing and migration	16° C
Salmon and trout spawning, non-core rearing and migration	17.5° C
Salmon and trout rearing and migration only	17.5° C
Non-anadromous interior redband trout	18° C
Indigenous warm water species	20° C

Washington also adopted a 9° C spawning criterion for char, and a 13° C spawning criterion for salmon. These criteria were to be applied to water bodies when the temperature criteria developed for the aquatic life use (e.g., Char - 12° C) were determined not to be protective of spawning. Washington did not indicate when or where the spawning criteria apply, although there is adequate information in the record to specify when and where the spawning criteria should apply to protect char and salmon spawning and incubation[2].

Washington's 2003 revised aquatic life designated uses are described in WAC 173-201A-200(1) and the application of those uses to specific waters are identified at WAC 173-201A-600(1) and 602 and are depicted on EPA's GIS maps titled *EPA Findings on Washington's Designated Uses* for the Washington Resource Inventory Areas (WRIA's) in Washington. These maps also identify the specific waters where EPA is acting to disapprove the designated uses, temperature criteria, or both[3]. These maps are in Appendix A and can be viewed at www.epa.gov/r10earth/washington-wqs.htm.

The designated uses adopted by Washington in its 2003 action are depicted on EPA's maps through the use of color coding. Streams coded **green** depict waters Washington designated as "Char" use, streams coded **light blue** depict waters Washington designated as "Core" use, streams coded **brown** depict waters Washington designated as "Non-Core" use, and streams coded **black** depict waters Washington designated as "Rearing and migration only" use.

Those streams where EPA is taking a disapproval action are also color coded on EPA's GIS maps. Streams coded as **dark blue** depict streams Washington designated as "Non-Core" use with a 17.5°C criterion that EPA is disapproving because the record indicates that they should be "Core" use with a 16°C criterion, streams coded **purple** depict streams Washington designated as "Core" use with a 16°C criterion that EPA is disapproving because the record indicates that they should be "Char" use with a 12°C criterion, streams coded **pink** depict streams Washington designated as "Non-Core" use with a 17.5°C criterion that EPA is disapproving because the record indicates that they should be "Char" use with a 12°C criterion, and streams coded **dark brown** depict streams Washington designated as "Rearing and migration only" use that EPA is disapproving because the record indicates that they should be "Non-core" use.

[2] In 2003, the court ordered EPA to rescind it's approval of Oregon's Water Quality Standards, in part, because Oregon did not specify when and where its spawning/incubation temperature criterion applied (*NWEA v EPA et.al.*, 268 F. Supp 2d 1255 (D. OR. 203).

[3] EPA is taking a disapproval action in WRIA's 1, 3-5, 7-11, 13-32, 34, 35, 37-39, 45, 46, 48, 49, and 62.

EPA has also developed GIS maps that depict where and when EPA is disapproving the 17.5°C, 16°C, or 12°C criteria because EPA has determined 13°C or 9°C needs to apply to protect salmon or bull trout spawning/incubation. This is depicted on EPA's GIS maps titled *Application of 13°C to Protect Spawning & Incubation* and *Application of 13°C and 9°C to Protect Spawning and Incubation.* These maps are in Appendix A and can be viewed at www.epa.gov/r10earth/washington-wqs.htm.

EPA analyzed the available information regarding known fish use, and timing by life history phase (*i.e*., the time frame when life stages such as spawning, juvenile rearing, and adult migration occur in a stream) when reviewing the State's use designations and temperature criteria. EPA primarily used the following databases from the Washington Department of Fish and Wildlife (WDFW):

1. the *Statewide Salmon and Fish Distribution* GIS database which provides the most recent information on salmonid distribution by life history phase, including known spawning and rearing, for specific species for specific waters,

2. the *Salmon Stock Inventory* (SaSI), which is a database of the spawning run timing periods for all known salmon runs in Washington.

These two databases contain the most complete and current salmonid distribution and timing information for the State of Washington. Hereafter the term "WDFW Databases" will be used to refer to information contained in these two databases.[4] Other site specific data, such as data from Tribes and the WDFW *Spawning Database*, were considered by EPA and incorporated into the analysis where the data could provide further clarification. EPA's disapproval and identification of necessary changes to the State's water quality standards are based on the above information which is part of the administrative record for the action taken today. Washington could include some variation to the changes specified in our disapproval action if there is a sufficient basis documented in the rulemaking record.

EPA's review also used the *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* (April 2003, hereafter referred to as the Temperature Guidance). The Temperature Guidance contains recommended temperature criteria for different salmonid uses (these uses and associated criteria are summarized in the table below), and it also contains a recommended approach for applying the different salmonid uses based on actual fish use information in streams. The scientific rationale and basis for EPA's recommended criteria is described in the Temperature Guidance and the supporting Technical Issue Papers. Tables B-1 and B-2 in Appendix B provide summaries of the important water temperature considerations, which forms the scientific basis of the recommended temperature criteria. The tables are taken from the Temperature Guidance. For more detail on the derivation of the numbers in the tables, see the Temperature Guidance and the Technical Issue Papers.

[4] Data from both of these databases can be publicly viewed and downloaded from WDFW's SalmonScape website at http://wdfw.wa.gov?mapping/salmonscape/index.html.

Salmonid Uses and Criteria	
Salmonid Uses During the Summer Maximum Conditions	Criteria
Bull Trout Juvenile Rearing	12° C
Salmon/Trout "Core" Juvenile Rearing (Salmon adult holding prior to spawning, and adult and sub-adult bull trout foraging and migration may also be included in this use category)	16° C
Salmon/Trout Migration plus "Non-core" Juvenile Rearing	18° C
Salmon/Trout Migration	20° C
Salmonid Uses Where/When Occur	
Bull Trout Spawning	9° C
Salmon/Trout Spawning, Egg Incubation, and Fry Emergence	13° C
Steelhead Smoltification	14° C
NOTES: 1. The temperature metric for each criterion is the 7-DADM. 2. "Salmon" refers to Chinook, Coho, Sockeye, Pink, and Chum salmon. 3. "Trout" refers to Steelhead and coastal cutthroat trout. 4. Bull trout is also known as Char.	

Basis for EPA's Disapproval

I. EPA is disapproving Washington's designation of certain waters for "Salmon and trout spawning, non-core rearing, and migration" use and the associated 17.5°C temperature criterion because the record demonstrates that these waters should be designated as "Salmon and trout spawning, core rearing, and migration" use with an associated 16°C temperature criterion.

EPA has determined that specific streams Washington designated as "Non-Core" use with an associated temperature criterion of 17.5° C do not protect several salmonid life stage uses, such as salmon juvenile rearing and spawning, which currently occur in these specific streams. These specific stream segments are coded as **dark blue** on the *EPA Findings on Washington's Designated Uses* GIS maps. EPA's rationale for disapproving these stream segments is discussed below.

The Temperature Guidance recommends applying a "Core" use designation and a 16° C temperature criterion for streams that currently have one or more of the following 5 factors:

1. moderate-to-high density *summer* juvenile salmon rearing
2. *summer* salmon/steelhead spawning or incubation
3. *summer* adult/sub-adult bull trout foraging and migration
4. *summer* juvenile rearing with current streams temperature at or below 16°C
5. the potential to support moderate-to-high density *summer* juvenile rearing that is important for the recovery of salmonids

EPA analyzed available fish information documenting these types of uses in Washington State. A summary of fish data and other information that EPA analyzed for each stream segment

designated as "Non-Core" use by Washington is presented in Appendix C. As noted above, EPA determined that the WDFW Databases contain the most comprehensive available information depicting these fish uses in Washington streams. Therefore, in making its disapproval decisions for water bodies that Washington designated as "Non-core" with a 17.5°C temperature criterion, EPA primarily relied on the WDFW Databases. However, where appropriate, other available information identified in Appendix C was also considered.

EPA notes that the WDFW Databases do not contain timing information documenting where summer juvenile salmon rearing and summer adult/sub-adult bull trout foraging and migration occurs (factors #1 and #3 above, respectively). Therefore, EPA could not directly determine which streams should be designated for "Core" use based on WDFW Databases for these two fish uses. However, the WDFW Databases do include timing information for salmon/steelhead spawning and incubation (factor #2 above). Therefore, EPA relied primarily on the salmon/steelhead spawning and incubation information contained in the WDFW Databases because both distribution and timing data are available to determine where spawning or incubation occurs during the summer.

Furthermore, EPA has determined that if stream reaches have summer salmon/steelhead spawning or incubation, this is a good indicator of other important fish uses that occur in these streams in the summer period. In particular: adult salmon typically hold in the weeks to months prior to spawning in the same reaches where they spawn; juveniles emerge from the gravels and typically rear in the summer in the vicinity of where they emerge (except for those that out-migrate as age 0 juveniles); and studies have shown that summer adult/sub-adult bull trout foraging and migration occurs in streams reaches where there is summer salmon/steelhead spawning or incubation (studies cited in Appendix C). Therefore, the WDFW Databases depicting summer salmon/steelhead spawning or incubation (factor #2 above) are a good surrogate indicator of both summer juvenile salmon rearing (factor #1 above) and summer adult/sub-adult bull trout foraging and migration (factor #3 above). Therefore, EPA has concluded that the WDFW Databases depicting summer salmon/steelhead spawning or incubation are the best available indicator of a variety of fish uses that should be designated as "Core" use and protected with a 16°C summer maximum criterion.

EPA has determined *summer* salmon/steelhead spawning and incubation is: (1) salmon spawning beginning in mid-September or earlier (in Washington some runs of Chinook, pink, sockeye, and/or chum spawning begin spawning in mid-September or earlier), or (2) steelhead spawning which ends in early June or later (because incubation will occur until late June or later; this is explained in more detail below). Accordingly, EPA has generally determined that streams where WDFW Databases show 1) salmon spawning beginning in mid-September or earlier *or* 2) steelhead spawning ending in early June or later, should be designated as "Core" use and protected with a 16°C temperature criterion.

There are several situations where EPA relied on site specific information that resulted in exceptions to EPA's general approach of relying on WDFW's Databases for determining where "Core" use is the appropriate use. In some situations, the WDFW Databases did not show summer salmon/steelhead spawning or incubation, but EPA did make a "Core" use

determination based on one or more of the other factors listed previously. In other situations, the WDFW Databases showed summer salmon/steelhead spawning or incubation, but EPA did *not* make a "Core" use determination. These decisions are discussed in Appendix D and are based on information presented in Appendix C.

The rationale for designating streams with summer salmon/steelhead spawning or incubation as "Core" use, with an associated 16°C temperature criterion, is summarized below.

1. Adult Chinook, pink, sockeye, and chum salmon runs that begin spawning in the summer (i.e., mid-September or earlier) are present at the spawning grounds days to weeks, or sometimes months (e.g., spring Chinook) prior to the onset of spawning. These holding adult salmon need summer maximum temperatures at or below 16°C with declining temperature prior to spawning to protect the adults from disease and maintain the viability of gametes (EPA Temperature Guidance Issue Paper 5 – Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmons pages 72-83).

2. Salmon stocks need daily maximum temperatures to decrease to 13°C during the time of spawning for good survival and growth of eggs (EPA Temperature Guidance Issue Paper 5 – Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids pages 30-38). Based on a review of the temperature patterns in Washington, streams with a 17.5°C summer maximum temperature are unlikely to cool to 13°C maximum temperatures by mid-September, but streams with a 16°C summer maximum temperature are more likely to cool to 13°C maximum temperatures by mid-September (Washington Department of Ecology, March 2005). Therefore, salmon stocks that begin spawning in mid-September or earlier are unlikely to be protected by a 17.5°C summer maximum criterion. *Note: Salmon stocks that begin spawning in July, August, or early September need the 13°C criterion to apply during the spawning period to protect spawning because a 16°C summer maximum criteria is unlikely to protect the spawning and early egg incubation of these early spawning stocks. This is discussed below in Basis IV of EPA's disapproval action.*

3. Incubating steelhead eggs need maximum temperatures to be at or below 13°C through the final stages of egg incubation and fry emergence for good survival and growth (EPA Temperature Guidance Issue Paper 5 – Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids pages 16, 30-38). Based on a review of the temperature patterns in Washington, streams with a 17.5°C summer maximum temperature are unlikely to have 13°C maximum temperatures needed to protect egg incubation at the end of June, while those rivers with a 16°C summer maximum temperature are more likely to have 13°C maximum temperatures at the end of June (Washington Department of Ecology, March 2005). Steelhead stocks that end spawning in early June will likely have significant number of eggs in the final stages of incubation and fry emerging in late June.

   A review of site-specific spawning and redd information indicates steelhead stocks that end spawning in early June (according to SaSI) will typically have substantial spawning

in mid-late May and occasionally have a few fish that spawn in early June. Steelhead eggs generally incubate in the gravels for 5-7 week Therefore, steelhead stocks where SaSI indicates spawning ends in early June will likely have a substantial number of eggs in the final stages of incubation and fry emerging into late June.

Note: EPA has also determined that 13°C needs to apply during the incubation period for steelhead stocks that end spawning in early June or later because the 16°C summer maximum criteria may not protect egg incubation and fry emergence in all streams. This is discussed below in Basis IV of EPA's disapproval action.

4. Salmon fry emerge from the gravel in the spring (and into the summer for steelhead). These juveniles begin rearing near where they emerged from the spawning grounds. Some juvenile Chinook and all steelhead rear over the summer during their first year of life. The waters in the vicinity of the salmon/steelhead spawning areas are important initial rearing areas for these juveniles and often have moderate-to-high density juvenile rearing use throughout the summer. EPA's Temperature Guidance recommends a 16°C summer maximum temperature criterion for important summer juvenile rearing areas to ensure optimal growth, minimize disease, and provide conditions where juvenile salmon maintain a competitive advantage over other fish species that may out compete salmon in warmer waters.

   Review of WDFW Databases show that coho spawn in many of the same streams that EPA has determined should have a "Core" use based summer salmon/steelhead spawning or incubation data. Coho, like steelhead and some Chinook, rear over the summer during their first year of life in the vicinity of their spawning grounds depending on the availability of rearing habitat. Therefore, in many of the streams that EPA has determined should have a "Core" use, summer coho juvenile rearing also occurs. Thus, coho will also be protected if Washington designates these waters as "Core."

5. As noted above, studies have documented adult and sub-adult bull trout summer foraging and migration use occur in many of the streams that EPA is making a "Core" determination based on summer salmon/steelhead spawning or incubation data. Maximum temperatures in excess of 16°C can reduce the growth of adult and sub-adult bull trout and create thermal stress that can place them at a competitive disadvantage with other fish species.

It is important to recognize the significant overlap of salmonid species use that currently occurs in most of the stream segments EPA has determined should be "Core" use. As can be seen from data presented in Appendix C, the stream segments Washington designated as "Non-core" use which EPA has determined should be "Core" use have:

1. *multiple* salmon species with adult holding and spawning in mid-September or earlier in many cases

2. *both* summer salmon spawning and steelhead egg incubation in most cases

3. juveniles of *multiple* species (Chinook, steelhead, and/or coho) that rear throughout the summer in most cases

4. adult and sub-adult bull trout summer use in some cases

Thus, these stream segments represent important summer salmonid habitat in Washington State because they are used extensively by a variety of species during different life stages in the summer.

For the reasons discussed above and based on the requirements of 40 C.F.R. 131.5(a) and (b); and 131.6(a) and (c); and 131.10; and 131.11, EPA is disapproving Washington's designation of the "Non-core" use and the associated temperature 17.5° C criterion for the specific waters identified on the *EPA Findings on Washington's Designated Uses* GIS maps because they do not protect the fish that use these stream segments. To address EPA's disapproval and to protect these fish uses, Washington needs to adopt a "Core" use and an associated 16° C temperature.

Finally, EPA is disapproving Washington's "Non-core" use designations and associated 17.5°C criteria for tributaries that drain into rivers that EPA has identified as needing a "Core" use and a 16°C criterion. EPA has determined that these tributaries should also be designated "Core" use with a 16°C criterion to assure that the downstream rivers attain the16°C criterion necessary to support their "Core" use designation. Additionally, this is consistent with Washington's approach for tributaries to streams with a "Core" use (see WAC 173-201A-600(1)). The *EPA Findings on Washington's Designated Uses* GIS maps for each of Washington's WRIAs where EPA is disapproving the "Non-core" use and associated 17.5°C criterion reflect this general approach.

However, in the lower elevation portion of several rivers, EPA determined it is not necessary for all tributaries to these river segments to have a 16°C criterion, unless summer salmon/steelhead spawning or incubation occurs in the tributary. This applies to tributaries to 1) the lower portions of the Nooksack, Skagit, Snohomish, Nisqually, and Klickitat Rivers and 2) the lower portion of four tributaries to the upper Yakima River (Teanaway River, Swauk Creek, Taneum Creek, and Manastash Creek). These lower elevation rivers are unique because EPA has determined that they should be "Core" use to (or nearly to) the mouth and they are glacially fed or drain mountainous regions. EPA believes a few relatively low flow tributaries with a 17.5°C criterion in the lower downstream portion of these rivers will have a negligible impact on attaining the rivers "Core" use designation.

II. EPA is disapproving Washington's designation of certain waters for the "Salmon and trout spawning, core rearing, and migration" use and the "Salmon and trout spawning, non-core rearing, and migration" use and the associated 16°C and 17.5°C temperature criteria because the record demonstrates that these waters should be designated "Char" use with an associated 12°C criterion.

In its revisions, Washington included a new designated use, "Char," to protect bull trout and Dolly varden spawning, tributary juvenile rearing, and other associated aquatic life that require cold water temperatures. Washington designated "Char" for specific waters based on WDFW's Statewide Salmon and Fish Distribution GIS database of known bull trout spawning areas in conjunction with an elevation and stream order model.

EPA analyzed data from WDFW and the United States Fish and Wildlife Service (USFWS) and found that there were certain waters where the designated "Core" or "Non-core" use would not protect bull trout spawning and early juvenile rearing. This is because the Washington "Char" use designations do not include all the streams where bull trout spawning or early juvenile rearing occurs or is likely to occur. Therefore, based on the requirements of 40 C.F.R. 131.5(a); 131.6(a); and 131.10, EPA is disapproving the use designation for specific streams because the use application is incorrect and the associated criteria do not protect bull trout spawning and juvenile rearing. These specific stream segments are coded as **purple** (for streams Washington designated as "Core" use) or **pink** (for streams Washington designated "Non-Core" use) on the *EPA Findings on Washington's Designated Uses* GIS maps. The basis for these determinations is described below.

EPA's Temperature Guidance recommends a 12°C criterion to protect bull trout juvenile rearing (Char) to ensure upper optimal temperatures are not exceeded in the summer growth season and to ensure water temperatures do not place bull trout at a competitive disadvantage with other fish species. When temperatures exceed 12°C and reach 16°C or 17.5°C, growth of juvenile bull trout is reduced and places them at a competitive disadvantage with other fish species (See Temperature Guidance and Technical Issue papers numbers 1 and 4). EPA, therefore, has determined that the 16°C and 17.5°C criteria do not protect bull trout juvenile rearing in these waters.

The specific stream reaches of EPA's disapproval are based on information from the USFWS and the WDFW Databases depicting bull trout spawning areas. The USFWS has developed draft recovery plans for bull trout that include streams in Washington (USFWS 2002, 2004). These draft plans include streams identified by USFWS to be key bull trout spawning and juvenile rearing habitat for the 124 local bull trout populations in Washington State. USFWS considers these streams to be important spawning and juvenile rearing areas for the recovery of bull trout. EPA developed GIS maps for each WRIA depicting Washington's "Char" use designations and the USFWS' draft key spawning and juvenile rearing habitat areas (See EPA's GIS maps titled *Comparison of Bull Trout key Habitat and Washington proposed Char Waters,* which can be viewed at www.epa.gov/r10earth/washington-wqs.htm). As can be seen from these maps there are approximately 92 stream reaches covering about 600 miles

identified by the USFWS draft plan to be key spawning and juvenile rearing habitat that are not designated as "Char" use by Washington (See Appendix E).

EPA analyzed information contained in the USFWS draft recovery plans, WDFW Databases for bull trout spawning, and other available information on bull trout use in each of these 92 stream reaches. This information is summarized in Appendix E. EPA notes that until recently very little emphasis was placed on monitoring the presence and distribution of bull trout by State, Federal, and Tribal agencies. Therefore, the information to support bull trout use is more limited compared to information on salmon species, which have been monitored for decades due to their commercial and sport value. EPA determined that a stream reach should be designated as "Char" use if: 1) bull trout spawning has been documented based on WDFW data or other sources, 2) bull trout spawning/early tributary juvenile rearing is presumed based on indicators of such use (e.g., documentation of adult spawners, multiple age class use, proximity to known spawning, or isolated juvenile rearing in conjunction with available spawning habitat), or 3) bull trout spawning/early tributary juvenile rearing is likely to occur in the near future because the stream reach is viewed to be within the historic range, has suitable habitat, and is necessary to connect areas of known use and provide sufficient area to support a local bull trout population

Applying the factors discussed above, EPA determined that Washington should designate approximately 69 of the 92 stream reaches as "Char" use and protect those waters with a 12°C temperature criterion. The documentation of "Char" use in the other 23 stream reaches was more speculative and did not provide an adequate basis for EPA to disapprove Washington's use designations in these stream segments.

III. EPA is disapproving Washington's designation of certain waters for the "Salmon and trout rearing and migration only" use because the record demonstrates that these waters should be designated as "Salmon and trout spawning, non-core rearing, and migration" use.

Based on the requirements of 40 C.F.R. 131.5(a); 1331.6(a); and 131.10, EPA is disapproving Washington's application of "Salmon and Trout rearing and migration" use to Mill Creek in WRIA 32, and to the lower Palouse River in WRIA 34 because the use designation does not reflect spawning that is known to occur in these waters. These specific streams are coded **dark brown** on the GIS maps titled *EPA Findings on Washington's Designated Uses*.

The WDFW Databases show that spawning occurs in both of these stream segments. In Mill Creek, steelhead spawning occurs, and in the lower Palouse River, below the falls, Chinook spawning occurs. This information is summarized in Appendix C. Because the "Salmon and Trout rearing and migration" use does not include spawning, this use designation is incorrect for these stream segments.

EPA has determined that Washington should designate these stream segments as "Non-core" use to recognize the spawning that occurs. The spawning/incubation that occurs in these

stream segments is not during the summer period and therefore does not meet the criteria for "Core" use (See Basis I of EPA's disapproval action for a discussion on when to apply a "Core" use).

IV. EPA is disapproving Washington's application of the 16°C and 17.5°C temperature criteria associated with the "Salmon and trout spawning, core rearing, and migration" use and the "Salmon and trout spawning, non-core rearing, and migration" use for specific waters where and when the record demonstrates that 13°C is needed to protect salmon and steelhead spawning and incubation.

Washington's "Core" and "Non-core" aquatic life use categories include spawning in the use definition. In accordance with 40 CFR 131.11 the associated criteria must protect the use. In its 2003 WQS revisions, Washington adopted a 13°C criterion (WAC 173-201A-200(1)(c)(iv)) to protect salmon spawning in situations where the 16°C and 17.5°C criteria associated with the "Core" and "Non-Core" use do not protect salmon spawning. However, Washington did not determine when and where the 13°C criterion applies. Absent specific application of the 13°C criterion, the 16°C and 17.5°C criteria are the applicable criteria to protect salmon spawning in Washington's 2003 revisions.

Based on the requirements of 40 C.F.R. 131.5(b); 131.6(c); and 131.11, EPA is disapproving the 16°C and 17.5°C temperature criteria for specific streams where and when EPA has determined these criteria do not protect salmon spawning and/or incubation and where and when the 13°C criterion is needed. This is depicted in EPA's GIS maps titled *Application of 13°C to Protect Spawning & Incubation* and *Application of 13°C and 9°C to Protect Spawning and Incubation.* Data to support disapproval is summarized in Appendix C. The color codes on the EPA's GIS maps reflect different time-frames 13°C needs to apply. For example, "Sept 1 - June 15" indicates that 13°C needs to apply from September 1 through the winter and spring until June 15. The "Char" uses adopted by Washington are also depicted on these maps because the year-around 12°C criterion associated with "Char" use will be the effective criterion in these waters. Thus, EPA is not disapproving Washington's adoption of 12°C (as shown on these maps) associated with Washington's designation of the "Char" use in these waters. The overlap of the "Char" use (12°C) and application of 13°C is shown on the maps to illustrate the degree to which salmon/steelhead spawning occurs in rivers designated for "Char" use. Below is a discussion of the basis of EPA's determinations.

EPA's Temperature Guidance recommends a 13°C criterion to protect salmon/steelhead spawning and incubation where and when this use occurs. Maximum temperatures of 13°C or less during the summer/fall when salmon begin to spawn and during the spring/early summer when salmon and steelhead fry begin to emerge from the gravels, will result in good survival of eggs, protect the gametes in holding adult salmon in the days prior to spawning, and will likely result in optimal egg incubation temperature (6-10°C) throughout the incubation period (See Temperature Guidance page 16). Maximum temperatures above 13°C during spawning and egg incubation are likely to result in a reduction in embryo and alevin survival. Maximum temperatures of 16°C or 17.5°C during spawning and egg incubation have shown significant to

complete loss of embryo and alevin survival (EPA Temperature Guidance Issue Paper 5 – Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmons pages 30-38). Therefore, EPA has determined that the 16°C and 17.5°C criteria do not protect spawning and incubation if it is likely that 13°C temperatures or lower will not occur during spawning through egg incubation.

In order to assure that the 13°C criterion will protect spawning and incubation, the criterion should generally begin to apply based on when *salmon* start to spawn and should generally end when *steelhead* eggs complete incubation (e.g., September 15 - June 15). This is because for many of the streams where EPA has determined 13°C is needed, both salmon spawning and steelhead incubation occurs in the summer. However, in cases where only salmon spawn in the summer, the dates for application of the 13°C criterion should begin to apply when the salmon stock begins to spawn and when salmon stocks typically complete egg incubation (e.g., Sept 15 - May 15). In cases where only steelhead eggs incubate in the summer, the dates for application of the 13°C criterion should begin to apply when steelhead stocks typically begin to spawn and when a stock's eggs complete egg incubation (e.g., February 15 – June 15).

Summer Salmon Spawning

After reviewing the temperature patterns in Washington rivers, EPA has determined that salmon runs that begin spawning in July, August, or early September (as listed in WDFW's SaSI) are unlikely to be protected by the 16°C or the 17.5°C 7DADM summer maximum criteria. Rivers with these summer maximum temperatures are unlikely to cool down to the 13°C maximum temperatures needed to protect spawning by the time the spawning period begins (Washington Department of Ecology, March 2005). Therefore, EPA has determined that Washington needs to apply 13°C to the WDFW spawning distribution of salmon stocks that start spawning in early September or earlier (as listed in SaSI and also listed in the 3rd column of the Appendix C).

EPA has determined that the start date for application of the 13°C criterion needs to be as follows: August 1st if SaSI timing indicates spawning starts in late July; August 15th if SaSI timing indicates spawning starts in early August or mid-August (if substantial spawning is documented in mid-August); September 1st if SaSI timing indicates spawning starts in late August or mid August (if documentation of spawning in mid-August is sparse); or September 15th if SaSI timing indicates spawning starts in early September. EPA has determined that the end date for application of 13°C is May 15th for salmon species (which typically emerge as fry by then) or later if steelhead spawning/incubation also occurs in the waters (see below for discussion of application of 13°C to protect steelhead egg incubation).

EPA considered multiple factors in the selection of the start date for application of 13°C (see factors considered below). EPA's Temperature Guidance recommends applying 13°C to the average date that spawning begins in recognition that the start date varies year-to-year. This variability is due to numerous factors that influence the decline of water temperature in the late summer-early fall including air temperature, stream flow, and precipitation. EPA reviewed field surveys of spawning live fish, redds, and dead fish and determined that the spawning start date

depicted in SaSI generally reflects the *earliest* redds documented for a particular stock over the period of record and that the typical date spawning begins is a week or so later than the earliest recorded spawning over the available data record. EPA, therefore, decided that 13°C should be applied later than the spawning start date indicated in SaSI (rounded to either the 1st or the 15th of the month as described above) to reflect the more typical spawning start date for the stock.

There were a number of other factors EPA considered that might suggest an earlier or a later beginning date for the application of 13°C than the recommendations described above. Factors that may suggest an earlier application of 13°C include:

- Field surveys of spawning are traditionally used to estimate the number of returning fish and run production for fisheries management purposes and are not necessarily intended to document the first spawners/redds. Thus, the beginning of spawning may not be fully documented in some years.
- Field surveys are done periodically, not daily, thus when a redd/dead fish is documented, actual spawning may have been days or a week prior.
- For some rivers, turbid conditions often prevent redd/spawner surveys in the summer, thus actual early spawning may not be documented.
- Human caused elevated temperatures are likely to have truncated the full timing distribution of early spawning stocks (*i.e*., historically, more fish spawned earlier, perhaps earlier than what is documented today), plus present day low returns in wild stocks are unlikely to exhibit the full timing distribution of the stock.

Factors that may suggest later application of 13°C include:

- For most salmon stocks, the week that spawning starts only represents a small percent (e.g., 5%) of the total number of spawning fish.
- In the past, it is likely a portion of some salmon runs spawned when temperatures were slightly higher than 13°C 7DADM. Exploitation of a range of environmental conditions is an important evolutionary trait of salmon, which maintains population diversity and thus the ability to adapt to environmental variability and disturbance.
- For salmon runs with a large spatial spawning distribution that encompass a large range of elevations, the earliest spawning may occur only in the higher elevation portion of the spawning distribution. Thus, if 13°C is to be applied at the lower elevation part of the distribution, this spatial difference in spawning timing needs to be considered. *Note: EPA found this to be true for some Washington streams and took this into account as discussed in Appendix D.*

EPA's approach described above as to the beginning date when 13°C needs to be applied to protect salmon spawning represents a scientific synthesis and best professional judgment after weighing the above factors.

Summer Steelhead Egg Incubation

After reviewing the temperature patterns in Washington rivers, EPA determined that steelhead eggs that incubate into late June may not be protected by the 16°C criterion and are unlikely to be protected by the 17.5°C 7DADM summer maximum criteria. Streams could attain the summer maximum criteria and yet have maximum temperatures higher than 13°C during late June. Steelhead eggs that incubate into July are even less likely to be protected by the 16°C and 17.5°C criteria.

As discussed in Basis I of EPA's disapproval (*i.e.*, disapproval of "Non-Core" waters), steelhead stocks that end spawning in early June will likely have significant number of eggs in the final stages of egg incubation in late June. This is because stocks that end spawning in early June will likely have significant number of spawners in mid-late May, which will result in a significant number of incubating eggs into late June (steelhead eggs typically incubate 5-7 weeks). Therefore, EPA determined that steelhead stocks where SaSI indicates spawning ends in early June or later are not protected by the 16°C and 17.5°C criterion and need the 13°C criterion to apply during the period of time when spawning and incubation occur in order to protect the incubating eggs.

Therefore, EPA has determined that Washington should apply the 13°C to the WDFW spawning distribution of steelhead stocks that stop spawning in early June or later (as listed in SaSI and also listed in the 3rd column of the Appendix C). EPA has determined that the 13°C criterion should apply from February 15 (when SaSI indicates steelhead typically start spawning in Washington) to June 15 (if SaSI indicates spawning stops in early June), July 1 (if SaSI indicates spawning stops in mid or late June), or July 15 (if SaSI indicates spawning stops in July). If summer salmon spawning also occurs in these streams, then the beginning date of the application of 13°C will be based on when salmon start spawning as discussed above.

In some situations EPA has determined that 13°C should apply based on site-specific information and considerations. These situations are discussed in Appendix D.

V. EPA is disapproving Washington's application of the 12°C temperature criterion associated with the "Char" use for specific waters where and when the record demonstrates that 9°C is needed to protect Char (bull trout) spawning and incubation.

Washington's "Char" aquatic life use category is intended to protect bull trout spawning, Dolly varden spawning, and early tributary rearing of native char (bull trout and Dolly Varden) and other associated aquatic life that require cold temperatures. In its 2003 WQS revisions, Washington adopted a 9°C criterion (WAC 173-201A-200(1)(c)(iv)) to protect bull trout spawning in situations where the 12°C criterion associated with the "Char" use does not protect bull trout spawning. However, Washington did not determine when and where 9°C applies.

Absent specific application of the 9°C criterion, the 12°C criterion is the applicable criteria to protect bull trout spawning in Washington's 2003 revisions.

Based on the requirements of 40 C.F.R. 131.5(b); 131(6); and 131.11, EPA is disapproving the 12°C temperature criterion for specific streams where and when EPA has determined the criterion does not protect bull trout spawning and where and when Washington needs to adopt the 9°C criterion to protect bull trout spawning. This is depicted on EPA's GIS maps titled *Application of 13°C and 9°C to Protect Spawning and Incubation* for WRIAs 27, 32, 35, 37, 38, 45, and 48.

The EPA Temperature Guidance recommends 9°C to protect bull trout spawning and incubation in order to ensure good embryo survival and size. EPA has determined that bull trout that spawn in August or early September are unlikely be protected by the 12°C summer maximum "Char" use criterion because temperatures are unlikely to drop to 9°C during the beginning of spawning. Accordingly, EPA has determined that Washington needs to apply a 9°C criterion to the waters in the WDFW spawning distribution of bull trout for populations that start spawning in early September or earlier. Information on bull trout spawning timing was obtained from WDFW's 1998 Bull Trout SaSI Report and more recent data collected by U.S. Fish and Wildlife Service, U.S. Forest Service, and WDFW. A summary of the information indicating areas where bull trout spawn in early September or earlier is presented in Appendix F.

If bull trout spawning timing from the above sources indicated bull trout start spawning in "mid-August," "late August," or "the last week of August," then Washington should apply 9°C starting August 21. If bull trout spawning timing information from the above sources indicated "September 1st" or "early September," then Washington should apply 9°C starting September 1. EPA determined the ending date for the application of 9°C should be May 15 because bull trout eggs have generally completed incubation by that date.